D2.5 SPARCS Open Information Management and Monitoring Toolkit

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Deliverable administration					
No & name	**D2.5** SPARCS Open Information Management and Monitoring Toolkit				
Status	Final draft	**Due**	M30	**Date**	31-03-2022
Author(s)	Georgios Papadopoulos, Katerina Vagena (SUITE5)				
Description of the related task and the deliverable. Extract from DoA	**T2.3 Data gathering from demonstration activities for evaluation (Suite5) M12 – M60** The aim of this task is to define a consistent methodology for the collection of data from the demonstration activities in lighthouse cities, to allow for the continuous monitoring of the project activities' progress and, subsequently, the assessment of the impact achieved by the project interventions in the lighthouse cities. Based on the evaluation and impact assessment framework defined in T2.1, this task will initially define the data requirements to facilitate the SPARCs Impact Assessment. Based on the analysis performed in T2.2, the required data will be linked to specific datasets and databases residing in the cities' systems or are published in the form of open data. Additional data required for the impact assessment activities of the project will be identified and relevant methods, rules and tools will be specified for their "standardized" collection and utilization in the overall framework defined in T2.1. This task will also result in an Open Information Management and Monitoring Toolkit, acting (i) as a data repository for impact assessment KPI-relevant data streams, (ii) as an interface for improving cities' open data publication capacity; reinforcing synergies with key actors and further extending the outreach of the SPARCS activities and added value.				
Participants	VTT, ESP, LPZ, KONE, SIE, PIT, CIT, ADV, WSL, LSW, CEN, SEE, ULEI, VERD				
Comments					

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About SPARCS

Sustainable energy Positive & zero cARbon CommunitieS demonstrates and validates technically and socioeconomically viable and replicable, innovative solutions for rolling out smart, integrated positive energy systems for the transition to a citizen centred zero carbon & resource efficient economy. SPARCS facilitates the participation of buildings to the energy market enabling new services and a virtual power plant concept, creating VirtualPositiveEnergy communities as energy democratic playground (positive energy districts can exchange energy with energy entities located outside the district). Seven cities will demonstrate 100+ actions turning buildings, blocks, and districts into energy prosumers. Impacts span economic growth, improved quality of life, and environmental benefits towards the EC policy framework for climate and energy, the SET plan and UN Sustainable Development goals. SPARCS co-creation brings together citizens, companies, research organizations, city planning and decision-making entities, transforming cities to carbon-free inclusive communities. Lighthouse cities Espoo (FI) and Leipzig (DE) implement large demonstrations. Fellow cities Reykjavik (IS), Maia (PT), Lviv (UA), Kifissia (EL) and Kladno (CZ) prepare replication with hands-on feasibility studies. SPARCS identifies bankable actions to accelerate market uptake, pioneers innovative, exploitable governance and business models boosting the transformation processes, joint procurement procedures and citizen engaging mechanisms in an overarching city planning instrument toward the bold City Vision 2050. SPARCS engages 30 partners from 8 EU Member States (FI, DE, PT, CY, EL, BE, CZ, IT) and 2 non-EU countries (UA, IS), representing key stakeholders within the value chain of urban challenges and smart, sustainable cities bringing together three distinct but also overlapping knowledge areas: (i) City Energy Systems, (ii) ICT and Interoperability, (iii) Business Innovation and Market Knowledge.

Partners

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LIST OF ABBREVIATIONS

Abbreviation	Full title
API	Application Programming Interface(s)
CIM	Common Information Model
CityGML	City Geography Mark-up Language
DMP	Data Management Platform
Dx.y	Deliverable x.y
DoA	Description of Action
DSO	Distribution System Operators
EC	European Commission
EU	European Union
EV	Electric Vehicle(s)
FC	Fellow City
gbXML	Green Building XML schema
GML	Geography Markup Language
ICT	Information and Communication Technologies
IPR	Intellectual property Rights
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
KPIs	Key Performance Indicator(s)
LHC	Light House City
PED	Positive Energy District(s)
RES	Renewable Energy Sources
SAREF	Smart Applications REFerence Ontology
SAREF4BLDG	SAREF for Buildings
SAREF4ENER	SAREF for Energy
SAREF4CITY	SAREF for City
SPARCS	Sustainable Positive and zero cARbon CommunitieS
SVF	SPARCS Visualisation Framework
TSO	Transmission System Operators
Tx.y	Task x.y
UI	User Interface

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USEF	Universal Smart Energy Framework
V2G	Vehicle-to-Grid
WP	Work Package

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EXECUTIVE SUMMARY

The present deliverable D2.5, entitled "SPARCS Open Information Management and Monitoring Toolkit", documents the activities and outcomes of T2.3 "Data gathering from demonstration activities for evaluation" of WP2 "Monitoring and Impact Assessment", up to M30 of the project's implementation. In alignment with the DoA, D2.5 steps on the specifications defined in D2.4(2021_D2.4) to develop an Open Information Management and Monitoring Toolkit allowing for (i) data gathering and storage for impact assessment KPI-relevant data streams, (ii) improving cities' open data publication capacity and reinforcing synergies between key city actors on the basis of data-driven collaborations.

In this direction, the main scope of this deliverable is to report the technical specifications and development activities for each of the components forming the *SPARCS ICT Ecosystem*, namely a) the SPARCS Data Management Platform, responsible for the collection, pre-processing and storage of data coming from the project's LHCs, b) the SPARCS Visualisation Framework providing to the cities' stakeholders an intuitive interface for monitoring their cities performance, through visualisation of appropriate impact-assessment KPIs and c) the SPARCS Common Information Model that will serve all the underlying semantic and syntactic interoperability issues faced during the anticipated data exchanges in the SPARCS ICT Ecosystem.

It shall be noted that as the D2.5 is of type OTHER, this document comes as an accompanying report, describing the work performed on the backend functionalities of the SPARCS DMP and the ongoing activities towards delivering its frontend environment. Upcoming work will also focus on implementing additional functionalities in data collection depending on the LHCs and stakeholders' data needs. In addition, D2.5 presents a comprehensive navigation to the deployed SPARCS Visualisation Framework (SVF), supplemented with screenshots of the actual software implementation, explaining in detail its functionalities. The delivered user interface and offered functionalities of the SVF are built on the mock-ups presented in D2.4(2021_D2.4) and D1.6(2021b_D1.6) respectively and the subsequent feedback received from both the technical and LHCs partners.

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1. INTRODUCTION

1.1. Purpose of the document

The document at hand, entitled D2.5 "SPARCs Open Information Management and Monitoring Toolkit" documents the development and implementation activities undertaken under the context T2.3 "Data gathering from demonstration activities for evaluation", which aims to define a consistent methodology for the collection of data from the SPARCS project's demonstration activities in the Lighthouse Cities (LCs), offering continuous monitoring of the project activities' progress , thus allowing assessment of the impact of the interventions carried out in the LHCs.

It shall be noted that as D2.5 is of type OTHER, this document is delivered as an accompanying report describing the work performed so far on the backend functionalities of the SPARCS DMP. All the components along with the functionalities described in this deliverable, are based on the latest SPARCS architecture (as defined in D2.4) thus differences may be noticed by the readers in terms of their naming (in contrast to their original names stated in the DoA).

In alignment with the DoA, a direct main outcome of T2.3, is the release of an Open Information Management and Monitoring Toolkit acting as the project's central data repository for collecting and storing impact assessment KPI-related data streams, while also enhancing cities' open data publication capacity, strengthening the collaborations among key actors towards further extending the outreach of the SPARCS activities and added value.

Under this context the main scope of this D2.5 is to report on the ongoing T2.3 activities by M30 of the project's implementation; presenting the work on the backend development of the **SPARCS Data Management Platform** (DMP), that will facilitate the collection, pre-processing and storage of data coming from the LHCs, strongly relying on the subsequent creation of the **SPARCS Common Information Model** (CIM) that will serve all underlying semantic and syntactic issues faced during the data exchanges in the SPARCS Ecosystem, and lastly the **SPARCS Visualisation Framework** (SVF) that provides to the cities' stakeholders an intuitive interface for monitoring their cities performance through visualisations depicting impact assessment KPIs.

1.2. Relations to other activities

The current document, D2.5, reports the initial activities carried out in the context of tasks: T2.3 "Data gathering from demonstration activities for evaluation" up to M30 of the project's implementation. To this end, the development activities and their early outcomes described in this deliverable are strongly based on:

- T1.3 - "Visualization framework for assessing city performance", and more specifically in D1.6 (2021b_D1.6) where the design specifications and latest mock-ups of the SPARCS Visualisation framework are provided.
- T2.1 - "Demo Evaluation, Impact Assessment and Cost-Benefit Analysis Framework and Associated Key Performance Indicator", where in D2.1 the preliminary key functionalities of the components forming the SPARCS Ecosystem were defined.

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- T2.2 - “Ex-Ante Lighthouse Demo Analysis and Detailed Baselining”, where in D2.3 (2020a_D2.3) the ex-ante analysis of the LHCs demos is provided.
- T2.3 - “Data gathering from demonstration activities for evaluation” defining the data requirements to facilitate the SPARCs impact assessment.
- T2.4 - “Socio-economic, environmental and technological Impact Assessment”; and more specifically on D2.4 (2021a_D2.4) documenting the early design specifications for the overall SPARCS ICT Ecosystem along with prototyping mock-ups that were used in the design of the offered functionalities.

In addition, the outcomes of D2.5 will be part of the overall system level software integration as the SPARCS DMP and SVF will be heavily utilised in the demonstration activities of WP3 “Demonstration Lighthouse City Espoo” and WP4 “Demonstration Lighthouse City Leipzig” and subsequently in the replication activities of WP5.

1.3. Structure of the document

To address all the aspects relevant to the scope of D2.5, the remaining of this document is structured as follows:

- Chapter 2 presents the backend development details for the various components and associated services offered to the users, outlining their scope, the implemented functionalities, the technologies leveraged for their implementation along with their license.
- Chapter 3 presents the development and implementation details for the SPARCS Visualisation Framework outlining its scope, implemented functionalities, the technologies leveraged for its implementation along with its license.
- Chapter 4 presents a user navigation to the SPARCS Visualisation Framework.
- Chapter 5 presents the conclusions of this document, along with the next steps of work.

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2. SPARCS DATA MANAGEMENT PLATFORM

The design specifications, including the architecture and preliminary functionalities/requirements for the various services (and associated subcomponents) forming the SPARCS DMP and their underlying components are defined in detail in D2.4(2021a_D2.4). This information formed the basis for the development of the backend functionalities of the SPARCS DMP offering the appropriate mechanism to facilitate all the planned services and which are namely:

- the **Data Collection service**, enabling the ingestion of data through various ways, such as file uploading, acquisition through Application Programming Interfaces (APIs), also allowing the performance of cleaning rules on the collected datasets so that any erroneous data are curated;
- the **Data Mapping service**, delivering an appropriate mechanism for linking the ingested data sets to the concepts of the SPARCS CIM, ensuring data homogeneity in the data exchanges within the SPARCS ICT Ecosystem;
- the **Secure Data Storage and Indexing service**, enabling the storage of the collected and pre-processed data in the secure repositories of the SPARCS DMP, ensuring their privacy;
- the **Data Searching and Retrieval service**, enabling users to explore datasets of interest residing in the SPARCS DMP, which if authorised they can retrieve, through the provided APIs;
- the **Data Preparation Service**, responsible for identifying and retrieving the appropriate data assets from the DMP's data storage layer and properly configure and correlate the retrieved data assets towards providing the resultant visualisation in the SPARCS Visualisation Framework (see Chapter 3).

As a reminder to the reader the architecture of the SPARCS Data Management Platform is depicted in the following figure, while detailed information on the specific components forming each of these services, can be found in D2.4. (2021a_D2.4)

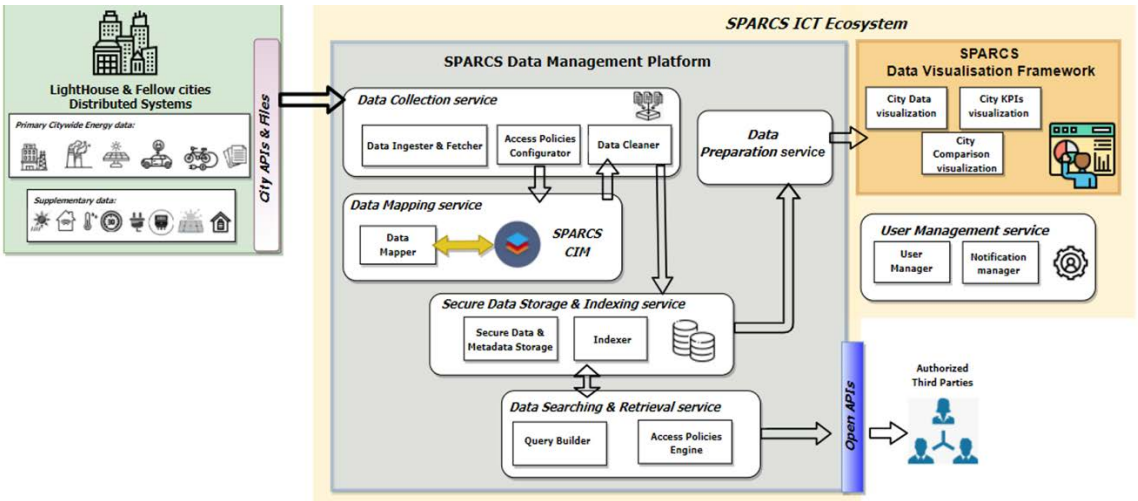

Figure 1: High Level Architecture of SPARCS ICT Ecosystem

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More information regarding the scope, implemented functionalities, the technologies and libraries leveraged for their implementation, along with their licenses, is provided in the following sections.

Once all LHCs data requirements are resolved and the frontend development activities conclude, the SPARCS Data Management Platform shall be accessible to authorised users through the following URL: https://sparcs.s5labs.eu.

2.1 Data Collection service

Overall, the Data Collection service is responsible for the collection of data (and any accompanying metadata) deriving from the various distributed energy sources of the project's LHCs (and from the FCs in the long run). This service enables users to manage how their data will be collected, specify the data extraction method according to their preferences, also select which part of the uploaded data should be stored in the SPARCS DMP, as well as (if required) apply data cleaning functions (e.g., removal of null values, etc.) to their datasets. An outline of the implementation details of the Data Collection service is presented in the following table.

Table 1 Data Collection service: Implementation details

<table>
<tr><th colspan="2">Data Collection service</th></tr>
<tr><td>Scope</td><td>Data gathering for impact assessment KPI-relevant data streams</td></tr>
<tr><td>Implemented functionalities</td><td>• Configuration of the data collection task in a user-friendly manner
• Configuration management of data collection task
• Data collection via file uploading (in various formats)
• Data collection via APIs
• Option for storage of specific data
• Provision of data collection status' notifications
• Quality checks and cleaning of data
• Provision of Access Policies to data provider's data</td></tr>
<tr><td>Leveraged technologies & Libraries</td><td>
<table>
<tr><th></th><th>Library</th><th>Version</th><th>Licence</th></tr>
<tr><td>Backend</td><td>Nest NodeJS</td><td>-</td><td>MIT</td></tr>
<tr><td>Storage Layer</td><td>MongoDB</td><td>4.4</td><td>Apache License 2.0</td></tr>
</table>
</td></tr>
<tr><td>Licensing</td><td>The Data Collection service forms part of the integrated SPARCS Data Management Platform, and delivered as a closed source component; thus its source code is not publicly available.</td></tr>
</table>

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2.2 Data Mapping Service

The Data Mapping service is responsible for undertaking semi-automated mappings of the collected datasets concepts to the concepts of the SPARCS CIM, in order for these to be transformed into the appropriate format and be available for further processing within the SPARCS DMP. Through this service, users are enabled to recognise their source data, the relevant concepts and fields of the SPARCS CIM (supported through mapping recommendations), ensuring their semantic and syntactic interoperability within the foreseen data exchanges taking place in the SPARCS Ecosystem.

An outline of the implementation details of the Data Mapping service is presented in the following table.

Table 2 Data Mapping service: Implementation details

<table>
<tr><th colspan="2">Data Mapping service</th></tr>
<tr><td>Scope</td><td>Mapping of the collected data to the concepts of the SPARCS CIM, generating interoperable and coherent datasets that can be used for further processing in the SPARCS DMP.</td></tr>
<tr><td>Implemented functionalities</td><td>• Generation of mapping predictions
• Manual confirmation of the proposed mapping predictions
• Exploration of the SPARCS CIM</td></tr>
<tr><td>Leveraged technologies & Libraries</td><td>
<table>
<tr><th></th><th>Library</th><th>Version</th><th>Licence</th></tr>
<tr><td>Backend</td><td>Flask</td><td>1.1.1</td><td>BSD 3-Clause</td></tr>
<tr><td rowspan="2">Storage Layer</td><td>MongoDB</td><td>4.4</td><td>Apache License 2.0</td></tr>
<tr><td>Elasticsearch</td><td>7.6.0</td><td>Elastic License</td></tr>
</table>
</td></tr>
<tr><td>Licensing</td><td>The Data Mapping service forms part of the integrated SPARCS Data Management Platform and delivered as a closed source component.</td></tr>
</table>

2.2.1 SPARCS Common Information Model

An early attempt to define the SPARCS CIM, was carried out in D2.4 (2021a_D2.4); based on this work and following the proposed methodological process (see Figure 1), this section presents the last two phases of the SPARCS CIM design process; Phase 3, which included the elaboration of its high-level concepts and their nesting (i.e., their interrelations), Phase 4 which involves the ongoing incorporation of the SPARCS CIM in the SPARCS DMP, an iterative processes involving the modelling of the fields (i.e., attributes) of each concept, their mapping to relevant standards (if applicable) and the configuration of their metadata.

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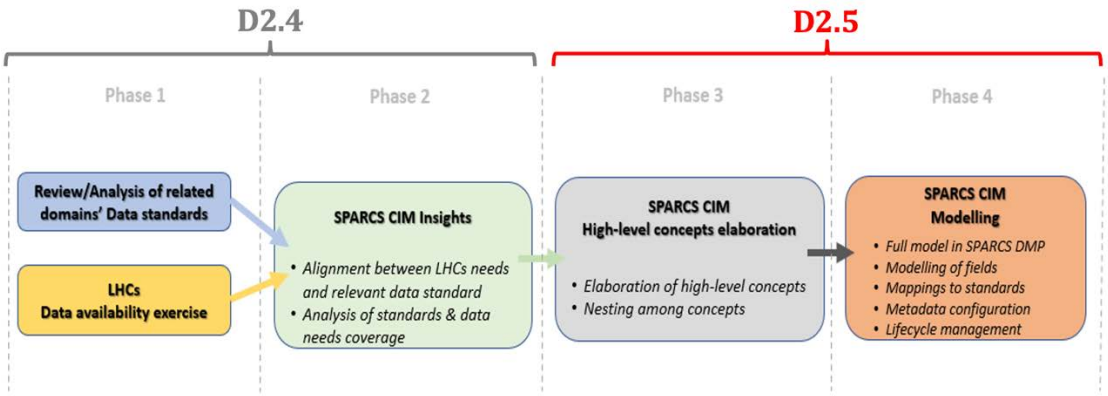

Figure 2: SPARCS CIM design process (updated from D2.4)

It shall be noted that the SPARCS CIM cannot be considered as final at this point, as it is anticipated to evolve and be regularly updated throughout the project's activities to capture any new requirements that may arise. As an early result of Phase 4 activities an overview of the high-level concepts (and their nested fields) extracted so far based on the sample LHCs demo data is presented in the following figure; while the latest version of the SPARCS CIM (once published) will be continuously available through the SPARCS DMP.

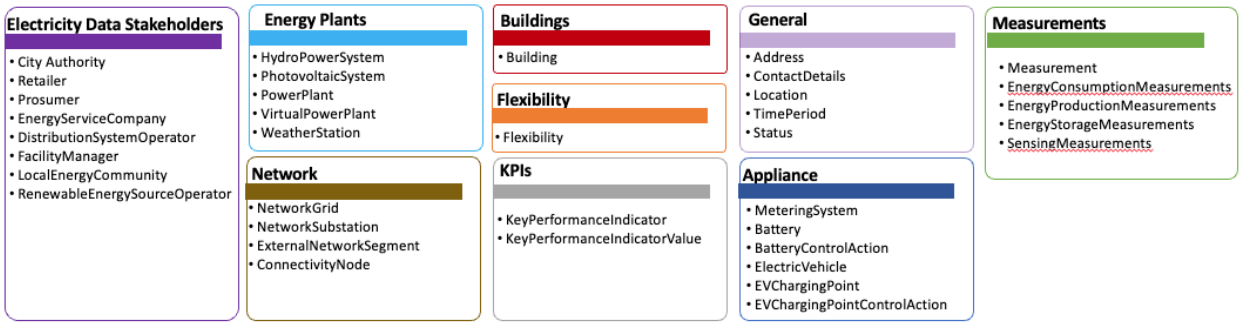

Figure 3: Initial version of the SPARCS CIM

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2.3 Secure Data Storage & Indexing service

The Secure Data Storage & Indexing service facilitates the secure storage of the collected data assets in the SPARCS DMP, also ensuring their privacy, so that they can eventually be available to be retrieved by any authorized user or third party fulfilling the respective access policies. Indexing capabilities are also offered through this service towards increased search performance.

An outline of the implementation details of the Secure Data Storage & Indexing service is presented in the following table.

Table 3 Secure Data Storage & Indexing service: Development details

<table>
<tr><th colspan="2">Secure Data Storage & Indexing service</th></tr>
<tr><td>Scope</td><td>Storage of data assets in the secure repositories of SPARCS DMP, while enabling indexing functionalities</td></tr>
<tr><td>Implemented functionalities</td><td>• Storage of the data collection tasks and corresponding configurations
• Data storage and indexing
• Metadata storage and indexing</td></tr>
<tr><td>Leveraged technologies & Libraries</td><td>This service is not visible to the users and represents the overall storage layer of the SPARCS Ecosystem.
<table>
<tr><th></th><th>Library</th><th>Version</th><th>Licence</th></tr>
<tr><td rowspan="2"></td><td>Elasticsearch</td><td>7.6.0</td><td>Elastic License</td></tr>
<tr><td>MongoDB</td><td>4.4</td><td>Apache License 2.0</td></tr>
</table></td></tr>
<tr><td>Licensing</td><td>The Secure Data Storage & Indexing service forms part of the integrated SPARCS Data Management Platform and delivered as a closed source component.</td></tr>
</table>

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2.4 Data Searching & Retrieval service

The Data Searching & Retrieval service addresses the data traceability and data sharing needs within the SPARCS DMP, enabling authorized data consumers and/or third parties to search for potential data assets of interest by generating appropriate queries, browse through the results and explore their details, and finally if interested retrieve the selected data asset through the platform's open APIs. An outline of the implementation details of the Data Searching & Retrieval service is presented in the following table.

Table 4 Data Searching & Retrieval service: Implementation details

<table>
<tr><th colspan="2">Data Searching & Retrieval service</th></tr>
<tr><td>Scope</td><td>Discovery and retrieval of data assets residing in the SPARCS DMP, upon resolution of the predefined access policies</td></tr>
<tr><td>Implemented functionalities</td><td>• User defined search queries
• Straightforward process for accessing the query results
• Data asset retrieval in a configurable manner</td></tr>
<tr><td>Leveraged technologies & Libraries</td><td>
<table>
<tr><th></th><th>Library</th><th>Version</th><th>Licence</th></tr>
<tr><td>Backend</td><td>Nest NodeJS Web Framework</td><td>12</td><td>MIT</td></tr>
<tr><td rowspan="2">Storage Layer</td><td>MongoDB</td><td>4.4</td><td>Apache License 2.0</td></tr>
<tr><td>Elasticsearch</td><td>7.6.0</td><td>Elastic License</td></tr>
</table>
</td></tr>
<tr><td>Licensing</td><td>The Data Searching & Retrieval forms part of the integrated SPARCS Data Management Platform and delivered as a closed source component.</td></tr>
</table>

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2.5 Data Preparation service

The Data Preparation service incorporates a data analytics part performing mainly data calculations and manipulation based on the context of the collected datasets (such as aggregation and simple statistical analysis) mostly addressing the data visualisation requirements of the SVF.

While this service is not visible to the users and all operations run in the background, for sake of completeness, an outline of its implementation details is presented in the following table.

Table 5 Data Preparation service: Implementation details

<table>
<tr><th colspan="2">Data Preparation service</th></tr>
<tr><td>Scope</td><td>Processing (e.g., aggregation, basic data analytics, etc.) of data assets to be able to be visualised in the SPARCS Visualisation framework</td></tr>
<tr><td>Implemented functionalities</td><td>• Feeding with data the appropriate KPIs calculations
• Extracting meaningful information (such as indicators and metrics) that can be presented in the SPARCS Visualization Framework, utilising the most appropriate visualisation libraries.</td></tr>
<tr><td>Leveraged technologies & Libraries</td><td>
<table>
<tr><th></th><th>Library</th><th>Version</th><th>Licence</th></tr>
<tr><td rowspan="3">Backend</td><td>Flask</td><td>1.1.2</td><td>3-Clause BSD</td></tr>
<tr><td>Pandas</td><td>1.2.1</td><td>BSD 3-Clause</td></tr>
<tr><td>Scikit Learn</td><td>0.24.1</td><td>BSD 3-Clause</td></tr>
<tr><td>Storage Layer</td><td>MongoDB</td><td>4.4</td><td>Apache License 2</td></tr>
</table>
</td></tr>
<tr><td>Licensing</td><td>The Data Preparation service forms part of the integrated SPARCS Data Management Platform and is delivered as a closed source component.</td></tr>
</table>

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3. SPARCS VISUALISATION FRAMEWORK

The SPARCS Visualisation framework is responsible for presenting information pertaining to the cities and planned interventions' performance, through various metrics and the output of the KPIs calculations, fed by data collected in the SPARCS DMP from the cities various systems towards creating cross-functional overviews and allowing monitoring and impact assessment.

As a reminder to the reader, the SVF is not intended as a standalone component; its operation heavily relies on the SPACS DMP. More specifically the SVF communicates with the SPARCS DMP through internal APIs, utilising the information processed in the Data Preparation service towards extracting meaningful visualisations to its users. Further details regarding the early considerations, the architecture and functional/technical requirements of the SVF can be found in D2.4 (2021a_D2.40), while the latest design considerations and final set of mock-ups upon which this stable release of the SVF is based are detailed in D1.6 (2021b_D1.6).

An outline of the implementation details of the SPARCS Visualisation Framework is presented in the following table.

Table 6 SPARCS Visualisation Framework: Implementation details

<table>
<tr><th colspan="2">SPARCS Visualisation Framework</th></tr>
<tr><td>URL</td><td>https://sparcs-vf.s5labs.eu</td></tr>
<tr><td>Scope</td><td>Visualisation of KPI-relevant data streams, enabling impact assessment of the interventions and monitoring of cities performance</td></tr>
<tr><td>Implemented functionalities</td><td>• Monitoring of the each LHC's performance, based on indicators and metrics fed with static and/or near real-time information (if available), as well as time-series data collected in the DMP.
• Monitoring and evaluation of the SPARCS project interventions' impact through appropriate preselected KPIs
• Direct comparison of the LHCs' performance through the use of appropriate KPIs</td></tr>
<tr><td>Leveraged technologies & Libraries</td><td>
<table>
<tr><td></td><td>Library</td><td>Version</td><td>Licence</td></tr>
<tr><td rowspan="3">Frontend</td><td>VueJS</td><td>2.6.11</td><td>MIT</td></tr>
<tr><td>TailwindCSS</td><td>-</td><td>MIT</td></tr>
<tr><td>ApexCharts</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Licensing</td><td>The SPARCS Visualisation Framework is delivered as a closed source component.</td></tr>
</table>

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4. NAVIGATION TO THE SPARCS VISUALISATION FRAMEWORK

The following sections provide a usage walkthrough to the SPARCS Visualisation framework, describing in detail the delivered functionalities offered to its users.

4.1. Home page (open access)

The Home page of the SPARCS Visualisation Framework is open access; meaning that anyone can access it through its dedicated URL: https://sparcs-vf.s5labs.eu.

As shown in Figure 4, the landing page presents basic info about the scope of the SVF, as well as a link to the SPARCS project's website[1] to increase reachability and traffic for both. From here, the user can select the SPARCS Lighthouse city of interest (Espoo or Leipzig) to see basic KPIs information.

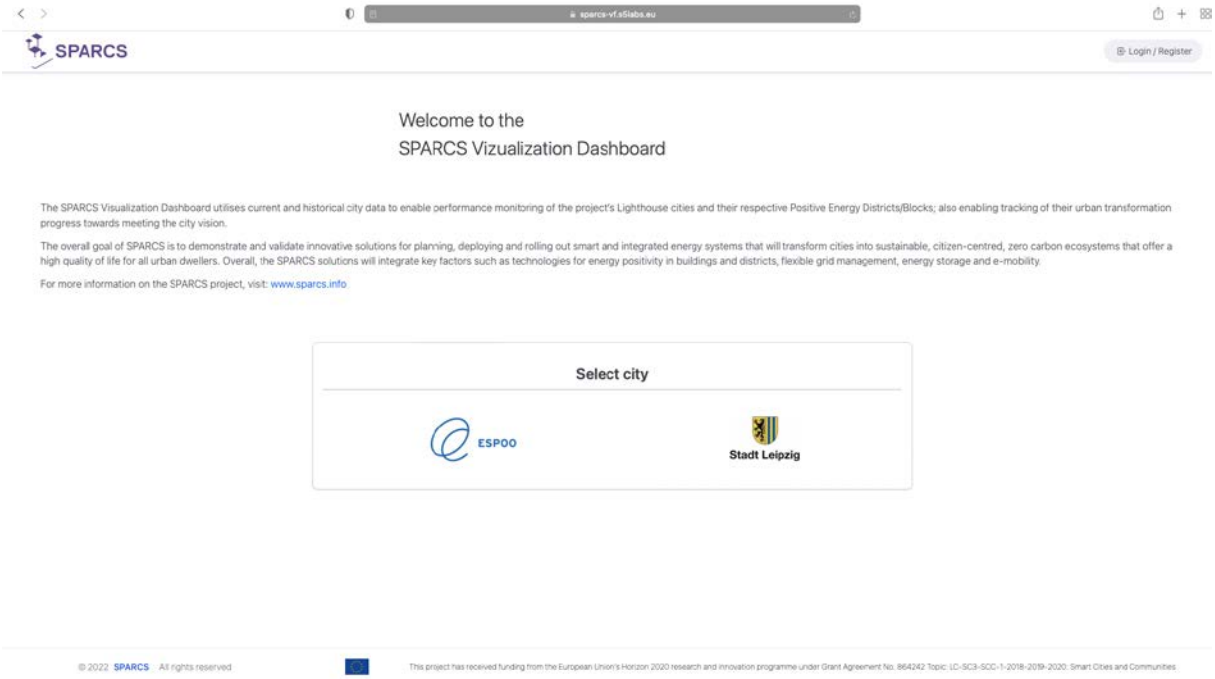

Figure 4: SPARCS Visualisation Framework - Home page (open access)

For example, if the user clicks on the Espoo, he/she is directed to the city's open access dashboard where a brief description of the city is provided, real-time weather data and air quality conditions, along with meaningful and easy to understand visualisations of basic KPI information regarding the city of Espoo (see Figure 5). It shall be noted that the KPIs visualised here, are based on the prioritisation methodology described in D1.7. The

[1] http://sparcs.info/

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same applies if the user selects the city of Leipzig, where he/she can view the KPIs prioritised for the open access view of this city.

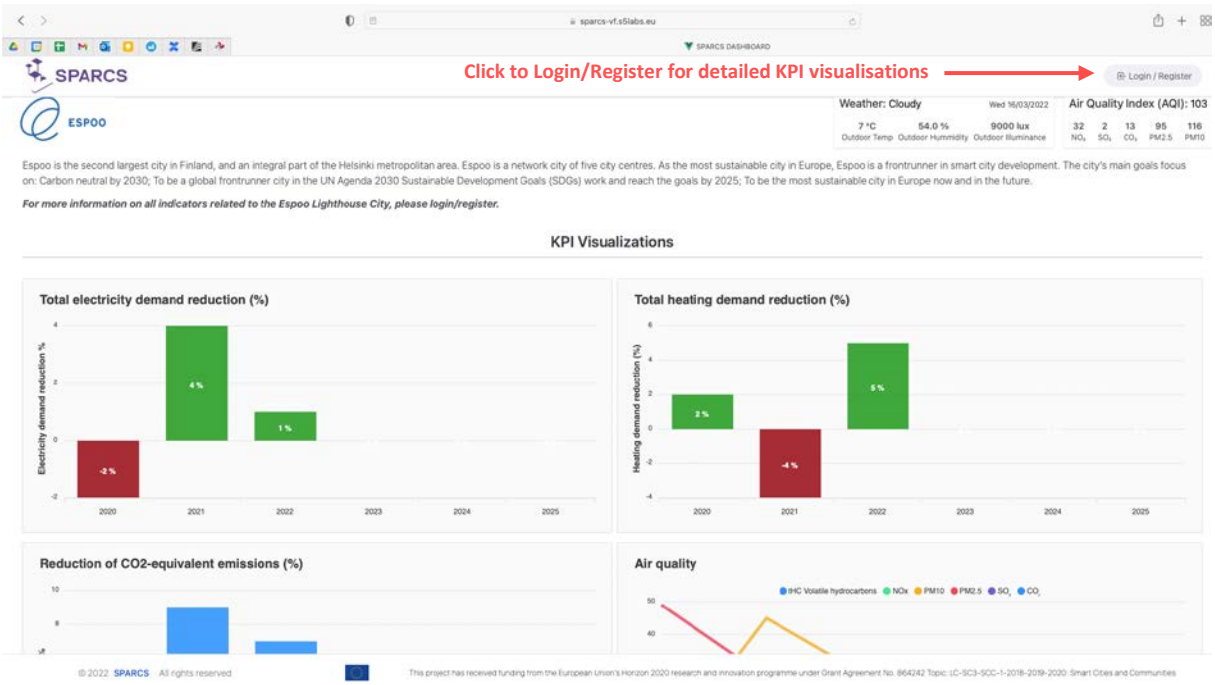

Figure 5: SPARCS Visualisation Framework - Espoo page (open access)

If the user is interested in a more detailed view of the LHCs performance visualizing each city's districts/interventions indicators and their respective districts KPIs, he/she shall register and/or log in to the SPARCS Visualisation Framework (through a separate log in process to the one accessing the SPARCS DMP) by clicking on the respective button (see Figure 5).

4.2. Registration & Authentication

Once a user clicks on the Login/Register button, he/she is directed to the respective page. As shown in Figure 6, for signing in the user is prompted to enter his/her credential (i.e., email and password). The user can also register (if not done previously) or recover his/her password if needed.

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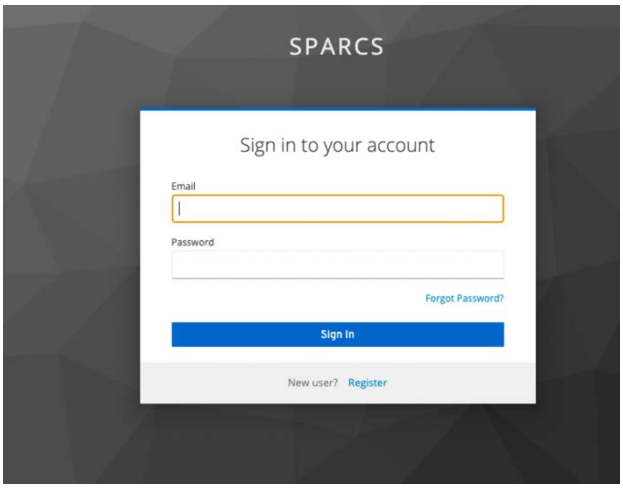

Figure 6: SPARCS Visualisation Framework – Sign in page

4.3. City indicators

Having successfully logged in to the SVF, the user is directed to the selected LHC's (e.g., Espoo) detailed KPI view (see Figure 7). Here the user can see various KPI visualisations revealing the city's performance. As described in D1.6, the KPIs are presented based on their prioritization; high priority KPIs are presented at the top, followed by medium and low priority KPIs which can be seen by scrolling further down.

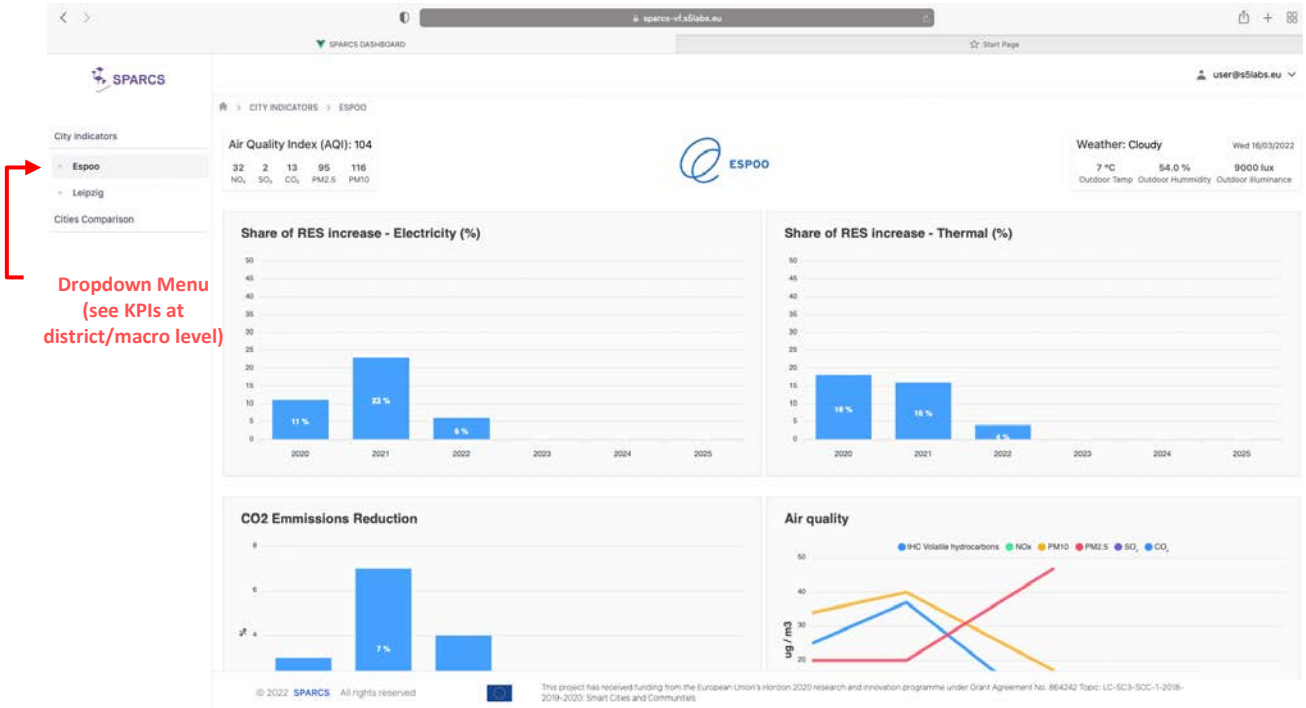

Figure 7: SPARCS Visualisation Framework – City Indicators (private access)

As shown in Figure 7 above, using the left-hand side menu, the user can see the KPI visualisations at district or macro level, as well as per category (energy, mobility,

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environmental, etc.). Moreover, by clicking on top of any KPI, its details are presented such as its description, its unit, application level, etc. (see Figure 8).

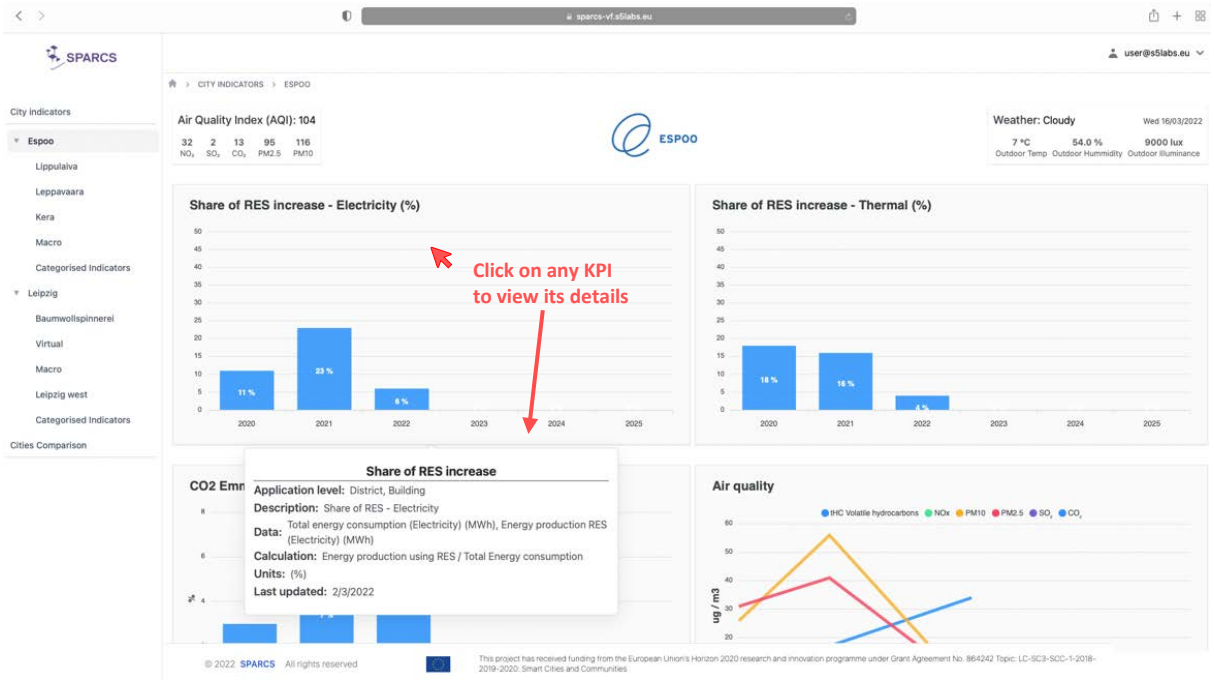

Figure 8: SPARCS Visualisation Framework – KPIs visualisation at district level

4.4. Cities Comparison

The second functionality of the SPARCS Visualisation Framework enables users to have a comparative view of the project's LHCs performance. As shown in Figure 9, once the user clicks on the "City Comparison" tab (from the left-hand menu), he/she is directed to the respective page. Here the user can see a direct comparison between the project's LHCs, looking at a KPI related to Espoo next to the same KPI for Leipzig.

Figure 9: SPARCS Visualisation Framework – Cities Comparison view

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It shall be the KPIs presented here, derived from the normalisation process (described in D2.2), which aimed at removing the particularities and exogenous characteristics of cities, thus enabling direct KPI comparison between the individual cities.

4.5. Signing out

At any time, the user can log out from the SPARCS Visualisation Framework, by clicking on the dropdown settings menu (top right corner) and then on the "Sign-out, this will direct him back to the open access page.

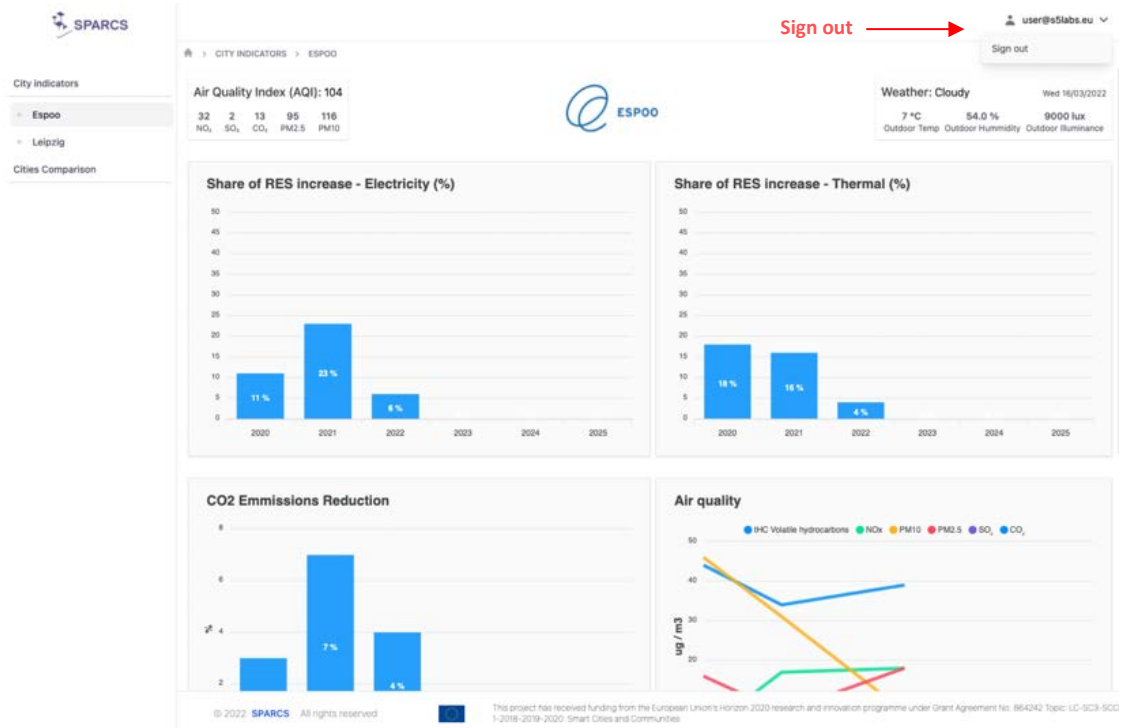

Figure 10: SPARCS Visualisation Framework –Sign-out

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CONCLUSIONS AND NEXT STEPS

The deliverable at hand, D2.5, entitled "SPARCS Open Information Management and Monitoring Toolkit", documents the activities and outcomes of T2.3 "Data gathering from demonstration activities for evaluation" of WP2 "Monitoring and Impact Assessment", up to M30 of the project's implementation.

In this direction, D2.5 comes as an accompanying report documenting the development activities of the SPARCS Data Management Platform, which allowed for the initial, stable release of the SPARCS Visualisation Framework, delivering an intuitive visualisation tool for enabling holistic cross-city impact assessment and evaluation of the SPARCS interventions. Towards an effective usage of the SVF, a detailed usage walkthrough is provided accompanied by screenshots of the actual software implementation, navigating the users to its offered functionalities.

The next steps of the work till the completion of T2.3 in M60, will focus initially on the frontend development of the SPARCS Data Management Platform (once all data collection needs are clarified and actual data are available from the project's LHCs), towards delivering an intuitive user interface offering to its users all planned functionalities. Further work will involve the integration of the various services of the SPARCS DMP and their end-to-end testing, integration with the SVF, as well as any bug fixing and/or improvements, further needs, that may arise once the actual data from the LHCs is available. In addition, user-training activities for both components with the project's partners will be undertaken, to familiarise themselves with the software and showcase all offered functionalities/services to the users.

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SPARCS (2021b_ D1.8) D1.8 - Strategy for developing interoperability and ecosystems for positive energy districts
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SPARCS (2021a_D2.4) D2.4 - Definition of SPARCS Holistic Impact Assessment Methodology and Key Performance Indicators.

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